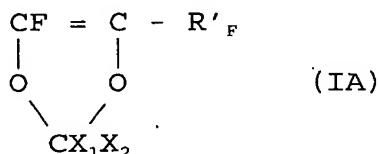


CLAIMS

1. Amorphous perfluorinated homopolymers and copolymers of perfluorodioxoles of formula (IA):



wherein R'_{F} is equal to R_{F} or OR_{F} wherein R_{F} is a linear or branched perfluoroalkyl radical having 1-5 carbon atoms, preferably $\text{R}'_{\text{F}} = \text{OCF}_3$; X_1 and X_2 , equal to or different from each other, are F, CF_3 ; having a dioxole content $\geq 95\%$ by moles, having the following combination of properties:

- Tg , measured according to the ASTM 3418. (DSC) method, from 180°C to 195°C , preferably from 190°C to 192°C ;
 - intrinsic viscosity, measured at the temperature of 30°C in perfluoroheptane (Galden® D80) according to the ASTM D 2857-87 method, from 13 cc/g to 100 cc/g.
2. Amorphous perfluorinated polymers according to claim 1, wherein in formula (IA) $\text{R}'_{\text{F}} = \text{OCF}_3$; $\text{X}_1 = \text{X}_2 = \text{F}$ (TTD).
3. Polymers according to claims 1-2, selected among the homopolymers of the perfluorodioxole of formula (IA) wherein $\text{R}'_{\text{F}} = \text{OCF}_3$; $\text{X}_1 = \text{X}_2 = \text{F}$.

4. Amorphous perfluorinated polymers according to claims 1-2, wherein the comonomers are selected from one or more of the following:

- C_2-C_8 perfluoroolefins, selected between tetrafluoroethylene (TFE), hexafluoropropene (HFP);
- perfluoroalkylvinylethers (PAVE) $CF_2=CFOR_f$, wherein R_f is a C_1-C_6 perfluoroalkyl, preferably CF_3 , C_2F_5 , C_3F_7 ;
- perfluoro-oxyalkylvinylethers $CF_2=CFOX$, wherein X is a C_1-C_{12} alkyl, or a C_1-C_{12} oxyalkyl, or a C_1-C_{12} (per)fluoro-oxyalkyl having one or more ether groups, preferably perfluoro-2-propoxy-propyl;
- perfluorodioxoles, wherein in formula (IA) instead of R'_F there is one F atom; X_1 and X_2 , equal to or different from each other, are selected between F or R_F , preferably $X_1 = X_2 = CF_3$;
- perfluorovinylethers (MOVE) of general formula $CFX_{AI}=CX_{AI}OCF_2OR_{AI}$ (A-I) wherein:
 - R_{AI} is a C_2-C_6 linear, branched perfluoroalkyl group or C_5-C_6 cyclic group, or a C_2-C_6 linear or branched perfluoro oxyalkyl group containing from one to three oxygen atoms;
 - R_{AI} can optionally contain from 1 to 2 atoms, equal or different, selected from the follo-

wing: Cl, Br, I;

- $X_{AI} = F$;

the compounds (MOVE I) $CF_2=CFOCF_2OCF_2CF_3$ and (MOVE II) $CF_2=CFOCF_2OCF_2CF_2OCF_3$ are preferred.

5. A polymerization process to obtain amorphous perfluorinated polymers according to claims 1-4, carried out in emulsion, suspension or microemulsion wherein the reaction temperature is lower than 60°C, preferably from 30°C to 50°C, and in the used reactor the reaction mixture is not in contact with metal surfaces.
6. A process according to claim 5 carried out in microemulsion.
7. A process according to claims 5-6, wherein a polymerization reactor is used, coated inside with glass or with inert materials, selected among enamels or fluorinated polymers, preferably PTFE, MFA, PFA, FEP, PCTFE.
8. A process according to claims 5-7, wherein the reactor is of glass.
9. Amorphous perfluorinated polymers of claims 1-4, wherein the ionic end groups are completely absent when determined by the analytical method described hereunder, said polymers obtainable by treating with elemental fluorine, optionally in admixture with inert gases, in an inert solvent at fluorination, in the

presence of ultraviolet radiations having a wave length from 200 to 500 nm, operating at temperatures lower than 100°C for reaction times from 10 h to 60 h; the method used to determine the substantial absence of unstable ionic end groups being carried out by Fourier Transform IR spectroscopy by Nicolet® Nexus FT-IR equipment (256 scanings, resolution 2 cm⁻¹), by using a sintered polymer powder pellet having a diameter of 5 mm and a thickness from 50 to 300 micron (1.75-10.5 mg of polymer) initially carrying out a scanning between 4000 cm⁻¹ and 400 cm⁻¹, then by maintaining the pellet for 12 hours in an environment saturated with ammonia vapours and then recording the IR spectrum under the same conditions of the initial spectrum; by elaborating the two spectra by subtracting from the signals of the spectrum related to the untreated specimen (starting spectrum) the corresponding signals of the specimen spectrum after exposure to ammonia vapours, obtaining the "difference" spectrum, which is normalized by the following equation:

$$\frac{\text{"Difference spectrum"}}{\text{[pellet weight (g)/pellet area (cm}^2\text{)]}}$$

by measuring the optical densities related to the COOH and COF end groups after the reaction with the ammonia

vapours, end groups giving rise with this reactant to detectable peaks; converting the optical densities into mmoles/kg of polymer by using the extinction coefficients reported in Table 1, page 73 of the publication by M. Pianca et Al. "End groups in fluoropolymers", J. Fluorine Chem. 95 (1999), 71-84 (herein incorporated by reference); in the spectrum of the polymers obtained by fluorination of homopolymers or copolymers of the dioxoles of formula (IA) prepared by the process according to the present invention, in correspondence of the wave length fields 3600-3500 and 1820-1770 cm^{-1} (COOH group peaks) and 1900-1830 cm^{-1} (COF groups), there are no peaks distinguishable from the irregularities of the IR spectrum base line.

10. Amorphous perfluorinated polymers according to claim 9, wherein the unstable ionic end groups are COF, COOH, their esters, salts or amidic derivatives.
11. Amorphous perfluorinated polymers according to claims 9-10, wherein the radiation used in the fluorination process has a wave length ranging from 200 to 500 nm and the reaction temperature ranges from 0°C to +100°C, preferably from +20°C to +50°C.
12. Amorphous perfluorinated polymers according to claims 9-11, wherein in the fluorination process the polymer

concentration in the solvent is between 1 and 10% by weight.

13. Amorphous perfluorinated polymers according to claims 9-12, wherein a perfluorinated solvent is used, selected from perfluoroalkanes, perfluoropolyethers, preferably having a boiling point lower than 200°C, tertiary perfluoroamines.
14. Use of the amorphous perfluorinated polymers according to claims 1-4 to prepare coatings.
15. Use of the amorphous perfluorinated polymers according to claims 9-13 for optical applications in the IR field from 600 to 1800 nm, preferably 1300 nm-1550 nm.
16. Use according to claim 15, wherein the intrinsic viscosity of the used amorphous polymers, measured at the temperature of 30°C in perfluoroheptane (Galden® D80) according to the ASTM D 2857-87 method, is comprised between 15 cc/g and 70 cc/g, preferably between 17 cc/g and 50 cc/g.
17. Use according to claims 15-16, wherein amorphous perfluorinated polymers of the perfluorodioxole of formula (IA) wherein $R'_F = OCF_3$; $X_1 = X_2 = F$, are used.
18. Use of amorphous perfluorinated polymers according to claims 1-4 to prepare films and membranes for the gas separation.

19. Use according to claim 18, wherein the intrinsic viscosity of the used amorphous polymers, measured at the temperature of 30°C in perfluoroheptane (Galden® D80) according to the ASTM D 2857-87 method, ranges from 20 cc/g to 100 cc/g, more preferably from 40 cc/g to 80 cc/g.
20. Use according to claims 18-19, wherein amorphous perfluorinated polymers of the perfluorodioxole of formula (IA) wherein $R'_F = OCF_3$; $X_1 = X_2 = F$, are used.